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Deep Pressure Therapy (DPT) Use in the Reduction of Challenging Behaviors for an Individual with Autism Spectrum Disorder and Intellectual Disability

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Deep Pressure Therapy (DPT) Use in the Reduction of Challenging Behaviors for an Individual with Autism Spectrum Disorder and Intellectual Disability

by

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Dedication

This paper is dedicated to my wife, Amy Suzanne Ota, for her support and patience and to my sons, Carter J. Ota and Marley B. Ota, for having to fend for themselves while “Dad did college.”

Acknowledgements

Thank you, among a countless number of professors and teachers, Dr. Terry Falcomata for your guidance, encouragement, and expertise.

Abstract

Deep Pressure Therapy (DPT) Use in the Reduction of Challenging Behaviors for an Individual with Autism Spectrum Disorder and Intellectual Disability

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Sensory integration therapy (SIT) has been used as an intervention for sensory sensitivities in individuals with autism spectrum disorder (ASD) for decades without clear empirical evidence of its efficacy. Recent research has supported the use of deep pressure therapy (DPT) when applied in varying degrees to the upper body. The T.Jacket (an app-driven vest with air bladders and pump) is an emerging and novel approach to DPT. This single-subject study examined the effects of the T.Jacket on off-task behavior and challenging behaviors in an individual adolescent with ASD, speech impairment, and intellectual disability. Experimental control was not established across all settings and phases for off-task behavior and challenging behaviors. Rationale is given for future research in an area of symptoms recently recognized in the DSM-5 (i.e., hyper- or hyporeactivity to sensory input) for ASD yet has little to no empirically based intervention.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Societal and clinical understanding of autism spectrum disorder (ASD) has made considerable changes in the past decade or more, transforming treatment from a medical to a social model (i.e., from corrective to functional therapy; Greenberg & Martinez, 2008; Mohammadzaheri, Koegel, Rezaee, & Rafiee, 2014). ASD is a neurodevelopmental disorder as defined by the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013; DSM-5) affecting multiple areas of social-emotional, verbal communication, and sensory development. Individuals with ASD can exhibit differences from typical peers in receptive and expressive language, social exchanges and connecting those exchanges to the building of reciprocal relationships, and the scope and depth of topics or activities of interest. The result is in how the individual functions in typical society where (a) many require moderate to extensive support restricting their educational environment and interaction in the community (Mehling & Tassé, 2015), (b) the most severe cases include challenging behavior (e.g., noncompliant, aggressive, and self-injurious behavior or SIB; Siegel et al., 2015), and (c) opportunities in adulthood can be hampered by unemployment/underemployment (Wilczynski, Trammell, & Clarke, 2013), victimization (Zablotsky, Bradshaw, Anderson, & Law, 2012), and increased risk for committing some crimes against others, particularly assault (Cheely et al., 2012).

The most significant change in understanding of ASD is in the area of sensory development and sensitivity. The American Psychiatric Association did not recognize hyperactivity to sensory input in autism until DSM-5 (American Psychiatric Association, 2000; American Psychiatric Association, 2013). Recent research suggests that individuals with ASD have a delayed reduction of synapses (i.e., neurons responsible for receiving

signals) starting at age 5, from which this atypical brain contains 3 times as many synapses than typical peers (Ota, 2014; Tang et al., 2014). The known symptoms (i.e., adverse reaction to touch, temperature, sound, texture, scents, and visual stimuli) may be a result of delayed "trimming" of the synapses in neurodevelopment and a "firing" of an overabundance of neuro-pathways for even low-intensity sensory input (Belluck, 2014; Ota, 2014; Tang et al., 2014). Where the research falls short, especially for individuals with limited communication modalities, is answering whether or not severe challenging and off-task behaviors appear to be a way to self-regulate sensory sensitivities (e.g., persistent covering ears with hands or singing/humming to drown out noise, biting or screaming to escape a chaotic room, or seeking "squeeze hugs" as a self-stimulatory function or aid to focusing). These types of challenging behaviors further compound the individual's ability to function and perform in an academic setting, family and social situations, and daily navigation within the community (Belluck, 2014; Ota, 2014; Robertson & Simmons, 2013; Siegel, et al., 2015; Tang et al., 2014).

While the understanding in why ASD and sensory sensitivity occurs is emerging, the most effective intervention to treat behaviors that serve the function of self-stimulatory is still debated. In particular, while the "gold standard" for the intervention for autism is applied behavior analysis (ABA; Yell, 2016), many parents seek out therapies that are not empirically proven as effective in reducing the symptoms and characteristics of autism (Zane, Davis, & Rosswurm, 2008). In particular, sensory integration therapy (SIT) is a form of occupational therapy that aims to de-sensitize the individual to external visual, auditory, and olfactory stimuli through controlled exposure. Therapists use devices like weighted or tight-fitting vests and blankets under the hypothesis that they will help the individual regulate sensory input to a tolerable level. These techniques continue to be popular with families and schools even though there is

inconsistent evidence to support their use; most research shows that SIT has little to no effect on challenging behaviors and some research has shown that the therapy can exacerbate them (Davis et al., 2013; Doughty & Doughty, 2008; Ota, 2014; Stephenson and Carter, 2009). Stephenson and Carter (2009) conducted a comprehensive review of research where SIT was used on individuals with neurodevelopmental disorders (including ASD). The authors included 7 studies involving 21 individuals (ages two to 11 years) and that mostly used alternating treatment or reversal design with SIT (i.e., weighted vests) as the independent variable and challenging behavior (e.g., self-stimulatory or off-task behavior) as the dependent variable. While 11 of the 21 participants experienced slight to moderate decreases in challenging behavior while or after wearing a weighted vest, most did not show improvement and four had increases in the challenging behavior. In addition, the positive results were not consistent across settings or study design. This is similar to findings of Lang et al. (2012) who examined twenty-five studies involving SIT that resulted in only three studies showing positive results. In addition, the researchers found that these three studies and most of the others reviewed had issues with design and implementation. Thus, they concluded that SIT should not be used in practice for individuals with ASD. Specifically, Davis et al. (2013) used a weighted vest with a 9-year-old male individual with autism who was biting across all functions of behavior (i.e., to obtain attention, escape, tangible items, or self-stimulatory); the multi-element design showed no visual decrease in the challenging behavior in an ABAB functional analysis. Doughty and Doughty (2008) studied the effects of a weighted vest on the SIB of a 14-year-old male with autism and intellectual disability (ID) and found little to no change.

Recent practice has suggested that applied deep pressure therapy (DPT; i.e., intervention that provides varying pressure on the upper body) may have positive effects

on behavior exhibited by individuals with ASD. In particular, an app-driven pressure jacket (called the T.Jacket) has gained some popular notoriety but has no direct empirical evidence in support of its use. DPT does have some research to support its use with individuals with ASD. Silva et al. (2015) conducted a study on the effectiveness of parent-delivered massage therapy with individuals with autism (ages two to five) on sensory sensitivities, self-regulation, and severity of ASD traits. The study used an experimental/control group design and randomized assignment of 84 participants into two equally sized groups. The results for the participants in the experimental group showed statistically significant decreases in abnormal sensory response, tactile/oral abnormalities, and self-regulatory difficulties pre- and post-intervention; between groups the authors showed significant decreases for the experimental group in severity, sensory, tactile/oral, and self-regulation measures. Blairs, Slater, and Hare (2007) applied a blanket swaddle on a 31-year-old male with autism and found that challenging behaviors and interactions (including aggression and restraint) decreased to near zero. McGinnis, Blakely, Harvey, Hodges, and Rickards (2013) studied the preference of DPT of three children with autism (ages two to seven years) where the DPT (e.g., blanket swaddling or mat sandwiching administered by the therapist) was associated with a symbol that changed in the order of items presented. The results showed that the preference of all participants followed the symbol representing DPT. In addition, DPT has been shown as a preferred treatment when given a choice (McGinnis et al., 2013) and that weighted vests alone are not the most preferred intervention by the participant (Doughty & Doughty, 2008).

Nonetheless, the empirical evidence of applied DPT and its effectiveness is limited; in addition, the behaviors studied are varied and not necessarily severe or challenging. In particular, the T.Jacket is a new approach to SIT using DPT and technology to which parents, educators, and practitioners may be drawn. Yet there is no

research substantiating its use with individuals with ASD and ID; the only study that could be found purporting its effectiveness was not peer-reviewed and its data, methods, and analyses are not available for examination (Poon, Chew, Tan, & The, 2014). Thus this study will focus on the effects of using the T.Jacket on off-task behavior and challenging behavior in an individual with autism and limited verbal skills. In doing so, the study will explore three questions:

- Does the use of DPT through an app-driven pressure vest decrease off-task behavior?
- Does the use of the DPT intervention decrease challenging behaviors?
- Does the use of the DPT intervention have social validity?

Chapter 2: Method

Consent and Site Selection

One high-school-aged individual receiving special education services in a specialized setting (i.e., Functional Academic Classroom or FAC) and diagnosed with autism (i.e., Level 3/severe ASD with no- or low-verbal skills) and low-incidence disabilities (i.e., moderate to severe ID) participated in the study. The individual had a history and current occurrence of off-task behavior; in addition, the individual displayed sensory sensitivity that contributed to challenging behaviors (i.e., withdrawal, aggression, and SIB) with a history of and comfortableness with using SIT devices. The school district was selected because the T.Jacket was a resource that it owned and implemented the intervention through occupational therapy services throughout the district for individuals deemed necessary within their IEP. This district, for which the author is an employee, recommended the selected school since there were potential participants who used SIT devices (e.g., weighted vests) but had not used the T.Jacket. In addition, potential participants needed to exhibit consistent challenging behaviors and have one parent willing to consent. Informed consent was obtained from the teachers and paraprofessionals who worked in an appropriate program with potential participants.

Potential participants were recruited through the FAC teacher and whose parent(s) were interested in consenting to the study (i.e., using the information from the consent form). The consent form was given to them personally or through the participant (i.e., the permission form was sent home with the participant or emailed/mailed directly to the parent by the FAC teacher). The form had the author's contact information if there were any additional questions about the study, materials, and/or use of the data. Assent was not pursued because the participant's disabilities likely precluded him/her from fully

understanding the particulars of the research and communicating informed consent; parents consented for the participant.

There was minimal risk involved with the use of the T.Jacket, which had been safely used with students in the same district for over a year. Because the participant and staff had a history of and were comfortable with the use of SIT devices, there was minimal risk involved with the use of the T.Jacket for the teacher and paraprofessionals after appropriate training of placing the jacket on the participant was provided. For any session in which the participant communicated refusal, the intervention ceased for that session.

PARTICIPANT, SETTINGS, AND MATERIALS

The participant was a 16-year-old male with ASD, ID, and speech impairment, which manifested as limited functional communication and challenging behaviors. (Specific assessment or historical data on diagnosis, treatment, or home services were not accessible or provided.) As reported by his teachers and a review of his educational records, his challenging behaviors included aggression towards staff and students (e.g., hitting, biting, or spitting), self abuse (e.g., hitting his extremities with a closed fist hard enough to leave multiple contusions, banging his forehead on hard surfaces, or hitting his fist on objects), and noncompliance (e.g., withdrawal in the forms of putting his head down, cradling into a ball on the floor, using objects to hide, or singing/humming when given a directive). His teachers, who had worked with him since enrolling in high school, also reported that multiple strategies had been attempted including picture exchange communication systems (PECS; both manual and with tablet technology), token exchange system, fidget items, tablet delivery of instruction, positive reinforcement with preferred items (e.g., edibles), and a vest that could be tightly wrapped around his upper

body. The results were little to no change and in some situations an increase in the frequency of the challenging behaviors.

The school at which the participant attended was a suburban, public, four-year high school with a total enrollment of over 2600 students. He received special education services 100% of the school day through FAC, which provided structured, individualized educational programming ranging from daily living, academic, and recreational skills. The entire program consisted of two teachers, three paraprofessionals, and fourteen students. The specific settings during which this study examined the participant's behavior were (a) morning jobs (MJ; i.e., small group setting of physical tasks such as sharpening pencils or shredding paper), (b) whole group lesson (WG; i.e., academic instruction presented with passive and active participation), (c) daily living skills (DLS; i.e., cooking or safety skills), (d) bus transition (i.e., morning transition from the bus through one hallway the width of the building to FAC), and (e) lunch transition (i.e., afternoon transition to and from the cafeteria through one hallway the length of the building). In all settings, the participant had a teacher or paraprofessional providing prompts, instruction, and/or redirection, and there were less than three total students in small group or transition settings and less than 10 total students in whole group settings.

The materials included a T.Jacket DPT device, iPad, and T.Ware app. Other materials included data collection sheets, writing utensils, and stopwatch (i.e., either stand alone or as an app). A T.Jacket could not be secured for the year for this particular campus and participant, so the author secured one at no cost to the school for the duration of the school year. The participant, his teachers and paraprofessionals, and parents did not receive any direct compensation for participating in the study. The T.Jacket remained with the FAC teacher and participant for the entirety of the remaining school year.

DEPENDENT VARIABLES

Behavioral data were collected by FAC staff and recorded by duration (i.e., time), partial interval (i.e., occurrences of challenging behavior), and setting. The dependent variable was off-task behavior, operationally defined as any behavior in which the participant engaged in activity or non-activity that was not reasonably associated with the task-at-hand. For example, during the morning job, off-task behavior included putting his head down at the table, folding up into a ball on the floor, or turning to spit. However, it was not considered off-task behavior if the teacher successfully prompted him to sharpen pencils while on the floor. In addition, if the participant was sitting up and looked away for a time when given the prompt to complete a task, this non-activity was not considered off-task due to his need for time to process; or if the participant spent considerable time cycling through ritualistic behaviors before complying with the prompt, this non-activity was not recorded as off-task since stereopathy was considered part of his disability and not deemed as being used for escape or avoidance. If challenging behavior occurred at any time within a 300-second interval, it was noted whether or not it was withdrawal (i.e., the participant was off-task and sleeping, hiding his head in his arms or hoodie, or out of his chair pacing or on the floor hiding, singing, and/or sleeping), aggression (i.e., the participant was off-task and hitting, pushing, scratching, and/or biting a peer or staff or spitting on the floor and/or in a trash can), or SIB (i.e., the participant was off-task and hitting with his fist/hand or his head against his own extremities such as arm or thighs or property such as a table, cabinet, or wall.

MEASURES

The participant and staff were involved in the study for a total number of 16 weeks. This included two weeks of training and retraining (if needed) at the beginning and two weeks of follow-up data. The time span of the study was five months. After the

initial 12-week period of data collection, staff continued the DPT intervention along with their normal instructional routines in the original three settings for one month. A follow-up period of data collection for two weeks (including one week of baseline data in two new settings) occurred one month after the 12-week period; data were collected on the duration of the off-task behavior and partial intervals of challenging behavior in the original three settings (i.e., maintenance) and two new settings (i.e., bus and lunch transition for generalization).

Each day of data collection was denoted as a session delineated by day and setting; e.g., during the baseline and intervention phases, data was collected in up to three different settings in one day. Data collection occurred in each week and phase of the study for at least three sessions each; if data collection fell below three sessions in one week, this was noted in the data analysis and results. Both the teachers and paraprofessionals were trained on how to collect data, either of which could be responsible for collecting the data. Data were collected in 300-second intervals throughout (expected) 30-minute sessions by measure of (a) duration (i.e., total seconds the participant was off-task) and (b) partial interval recording (i.e., the number of intervals when withdrawal, aggression, and/or SIB occurred). The duration was totaled for each interval and averaged per session per setting; the average duration was divided by 300 and then multiplied by 100 to find the percentage of average duration of off-task behavior for every session per setting. The percentage of partial intervals was found by counting the number of intervals in which the behavior occurred then divided by the total number of intervals multiplied by 100 for each phase.

Data were collected over the 12-week period by the staff after appropriate training and re-training of how to record data and agreement on what constituted off-task and challenging behaviors. The author was initially present for the first week that the study

commenced and then randomly thereafter for more than 20% of the sessions. The staff could call on the author for observation and guidance at any time. Each baseline phase was terminated based on a visual analysis of three or more data points; multiple baselines were staggered by at least two data points.

DESIGN AND PROCEDURES

The study consisted of a single-case, ABAC design with multiple baselines across different settings (determined by where the most challenging behaviors were occurring). For the baseline phase (A), there was no consequence for the off-task behavior and no alternative stimuli were presented. For the established intervention phase (B), the participant used a DRO method (contingent on compliance with four or five steps in a work task) and Velcro tokens were used to exchange for a preferred reinforcer at the end of the session. During the experimental intervention phase (C), the participant received the DPT intervention (i.e., wearing the T.Jacket driven by an app cycle of inflation and deflation). The staff working with the participant at that time was responsible for implementing the intervention (after appropriate training) and collecting the data. Training had been given to both staff and the student on how to put on the jacket, how to operate the jacket, and how to use the release valve. Furthermore, staff and the author worked with the student through procedures on how he could communicate to terminate the session (e.g., saying “No” or “Off”), turn the inflation off (i.e., by pressing on the power button), and/or take the jacket off himself by unzipping the jacket and physically removing the clothing from his upper body.

VALIDITY

Inter-observer agreement (IOA) was calculated by randomly collecting by the author the same data as the teacher/paraprofessional working with the participant in more

than 20% of the sessions. Agreement was calculated by dividing the lesser duration by the greater duration and then multiplying by 100 for each session; these percentages were then averaged to find IOA. Of these sessions, 92.7% were in agreement; 94.0% agreement occurred during MJ sessions, 90.1% during WG, 91.2% during DLS sessions, 100% during bus transition, and 100% during lunch transition. In addition, fidelity on the implementation of baseline/intervention sessions was taken in 10% of sessions. Integrity was noted if the teacher/paraprofessional followed the correct procedures for each phase. Of these sessions, 100% were in agreement.

Chapter 3: Results

FAC Settings (ABAC Phases and Follow-up–Maintenance)

In all, there were 61 sessions for MJ and WG activities and 62 sessions for DLS. Each session averaged 27.4 minutes for MJ, 29.7 minutes for WG, 29.9 minutes for DLS, 16.25 minutes for bus transition, and 15.7 minutes for lunch transition. The teachers provided reasons for gaps in the data, including (a) changes in routine (e.g., field trip), (b) absence, (c) assessment, or (d) therapeutic services. In 79 sessions in the first three settings during which the jacket was used, the participant rejected the intervention only five times or 6.3%; in the follow-up transition settings, this occurred in one out of eight sessions or 12.5%; at each occurrence, the jacket was taken off and data collection ceased. Baseline data was collected in all three FAC settings until a visually stable pattern of behavior was established; MJ was chosen first since this was the setting in which the most challenging behavior had historically occurred.

Morning Jobs

When the baseline was established in the MJ setting, the token system with which the participant was already familiar was provided for incentive of task completion. For example, five tokens were given if he finished sharpening five pencils; he could then exchange those five tokens for a preferred item, like tablet time, beanbag time, or an edible. At first he seemed responsive to the DRO, but the off-task behavior during the established intervention (47.8% average off-task duration of 300-second intervals) quickly returned to baseline levels (45.8%; see Figure 1 and Table 1). Once enough data had been collected for phase B (i.e., by session 23), all three settings went back to baseline procedures where no intervention was provided other than redirection, prompting, or prevention of injury to self or others. In the MJ setting, the participant did

continue his off-task behavior relative to first baseline levels. Once the baseline levels had been re-established in all three settings, the experimental intervention of using the jacket was implemented and appeared to have little effect on off-task behavior during MJ; in fact, the behavior increased (62.5%). After session 57 (for the MJ and WG settings) and session 58 (for DLS setting), data collection ceased for five weeks while the participant could periodically use the jacket and then it resumed for one week. There was a considerable drop in off-task behavior (38.3%) during MJ activities. Visual analysis, however, provided no discernable pattern for experimental control in the use of either interventions (i.e., tokens or jacket) for the MJ setting; descriptive data showed that the data was highly variable (i.e., standard deviations for both interventions were greater relative to baseline standard deviation).

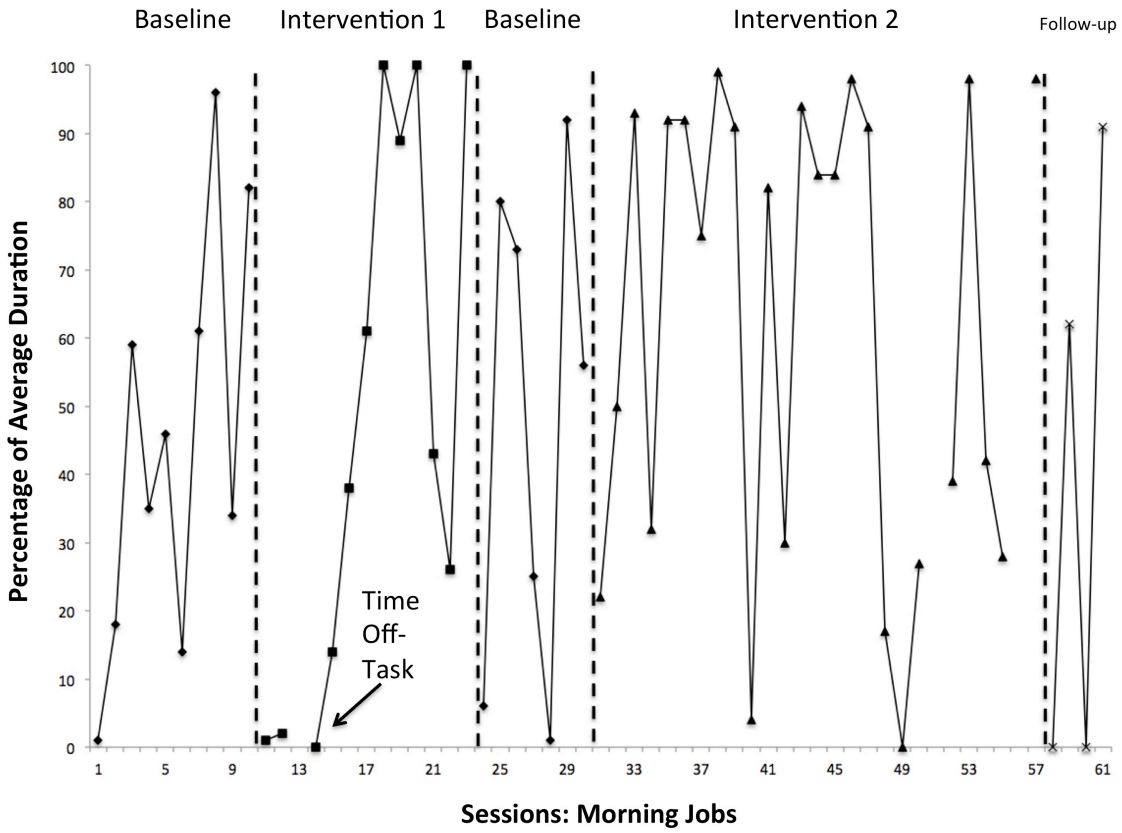

Figure 1: Average duration as a percentage of 300-second intervals of off-task behavior in the morning jobs setting.

Table 1: Descriptive data of percentage of average duration in the morning jobs setting.

Average Duration Percentage	Baseline	Intervention 1	Intervention 2	Follow-up
Mean	45.8	47.8	62.5	38.3
Median	46.0	40.5	82.0	31.0
SD	32.1	40.8	34.4	45.7

Whole Group

The baseline data for WG activities had a lower average duration of off-task behavior (37.2% compared to 45.8%), but these activities preceded lunch and the

participant was typically more engaged than in the morning when he was usually sleepier. (See Figure 2 and Table 2.) These setting events could also explain why there was a considerable change in the target behavior with the established intervention (dropping to 24.4%). However, the percentage of off-task behavior increased with the experimental intervention (44.7%). These data continued in follow-up with an even greater increase (49.5%) relative to baseline. Although there was some evidence that the use of the former in the WG setting initially decreased off-task behavior, visual analysis showed there was no experimental control for either the established (i.e., tokens) or experimental intervention (i.e., jacket). Descriptive data supported this analysis as the use of tokens was considerably less variable (i.e., standard deviation for Intervention 1–tokens was 15.4 and for Baseline was 32.6) and higher for the jacket (i.e., standard deviation for Intervention 2–jacket was 39.4).

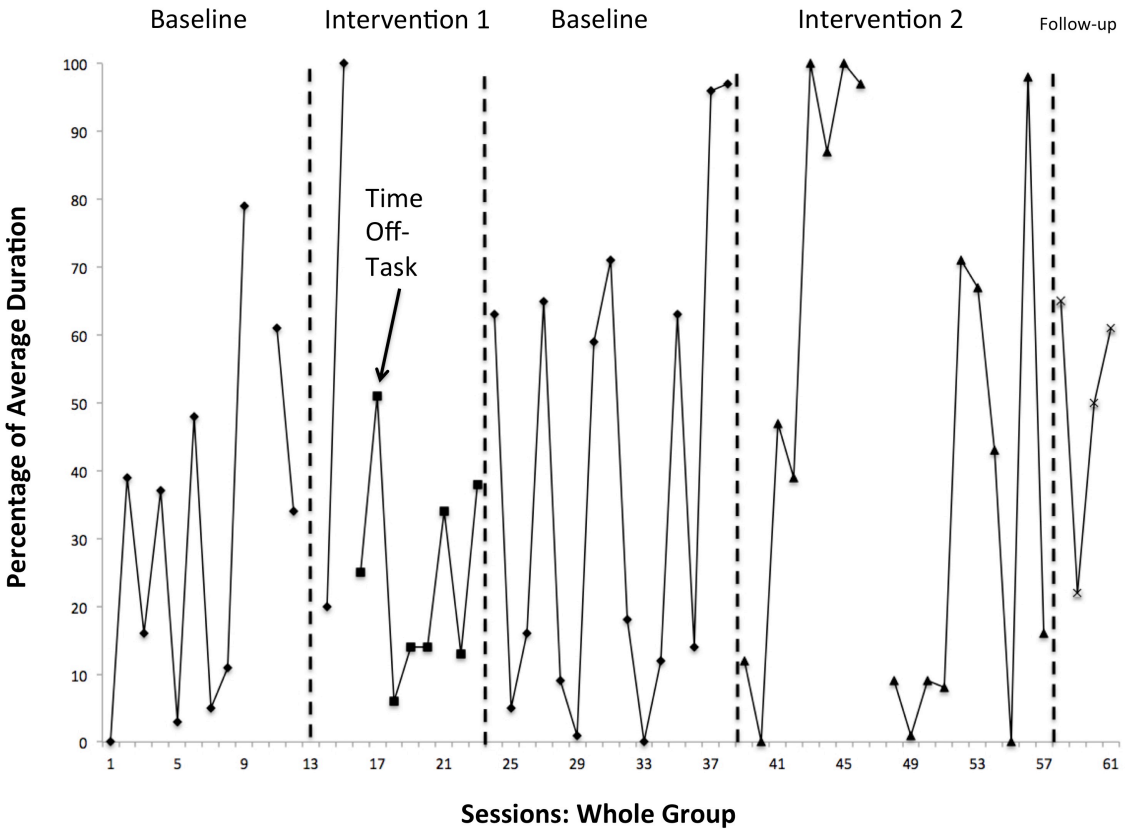

Figure 2: Average duration as a percentage of 300-second intervals of off-task behavior in the whole group setting.

Table 2: Descriptive data of percentage of average duration in the whole group setting.

Average Duration Percentage	Baseline	Intervention 1	Intervention 2	Follow-up
Mean	37.2	24.4	44.7	49.5
Median	27.0	19.5	41.0	55.5
SD	32.6	15.4	39.4	19.4

Daily Living Skills

The afternoon activity of DLS also had a lower average duration of off-task behavior when compared to MJ activities (36.6% compared to 45.8%). The teachers

reported that the participant was often motivated by food and the highest level of SIB had historically occurred during this time. (See Figure 3 and Table 3.) However, these setting and antecedent events did not explain why there was such a considerable change in off-task behavior with the experimental intervention (dropping to 20.2%) and an increase with the established intervention (49.3%). Although there was some evidence that off-task behavior decreased for both interventions, visual analysis showed no evidence for experimental control in the use of the established and experimental interventions in the DLS setting; descriptive data supported this analysis as the use of the jacket was less variable (i.e., standard deviation for Intervention 2 was 27.1 and for Baseline was 31.6) and considerably less in follow-up (i.e., mean and standard deviation for Follow-up–jacket was 2.0% and 3.5, respectively).

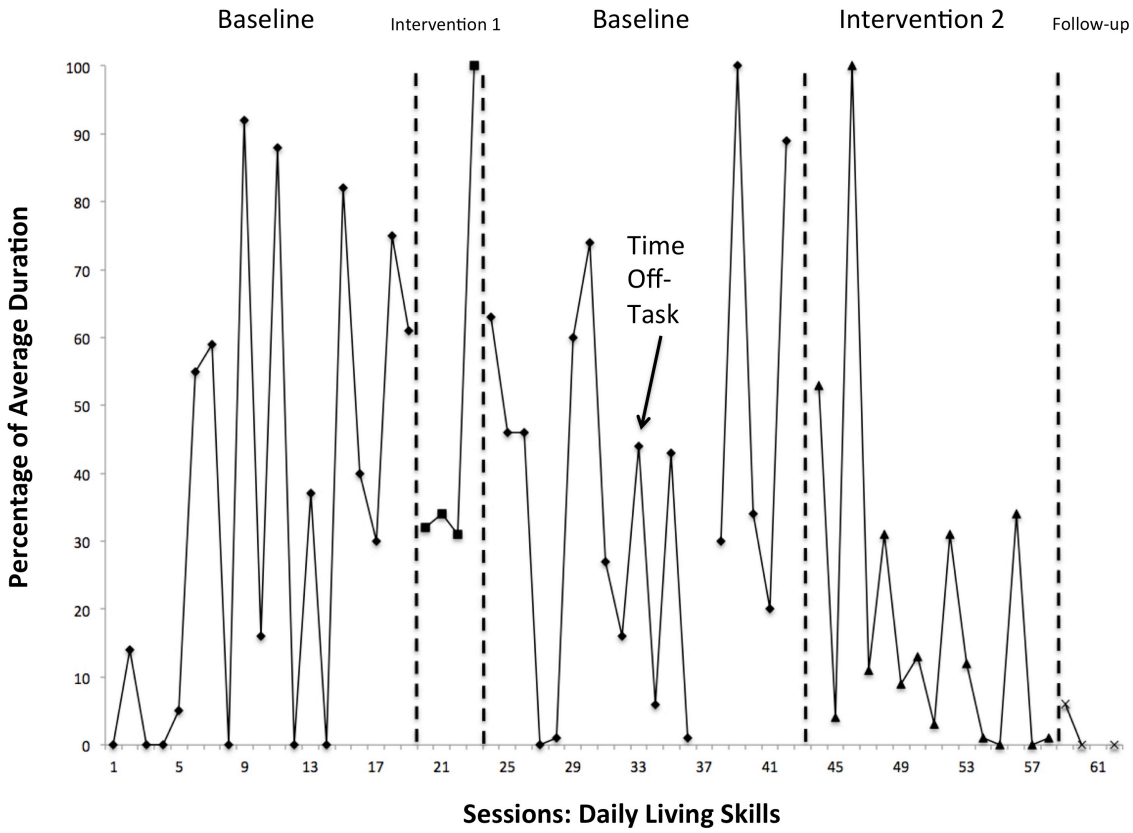

Figure 3: Average duration as a percentage of 300-second intervals of off-task behavior in the daily living skills setting.

Table 3: Descriptive data of percentage of average duration in the daily living skills setting.

Average Duration Percentage	Baseline	Intervention 1	Intervention 2	Follow-up
Mean	36.6	49.3	20.2	2.0
Median	34.0	33.0	11.0	0.0
SD	31.6	33.9	27.1	3.5

FOLLOW-UP (GENERALIZATION)

Two settings outside of the FAC setting were chosen to establish generalization with use of the jacket and baseline data was taken for both three weeks after data collection had ceased in the three FAC settings. One setting was the transition from the morning drop-off of the bus. (See Figure 4 and Table 4.) Baseline data established a fairly high level of off-task behavior (50.0%), but visually analysis (although at first there was a decrease) and descriptive data did not support a decrease in the behavior with use of the jacket (54.4%). The other setting was the transition to and from the lunchroom to pick up lunch and eat in the FAC setting. (See Figure 5 and Table 5.) Baseline data also showed a high level of off-task behavior (60.0%) in this setting with a change with use of the jacket (0.0%), but visual data did not support experimental control .

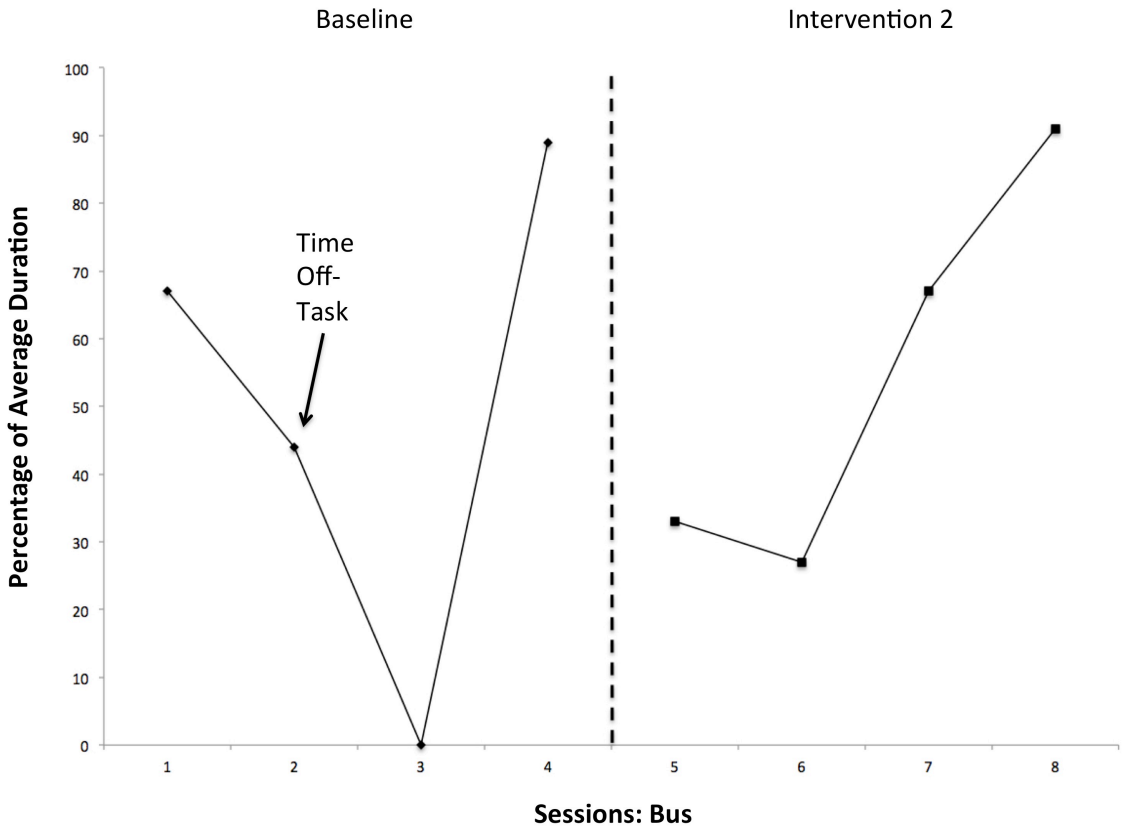

Figure 4: Average duration as a percentage of 300-second intervals of off-task behavior in the transition from bus setting.

Table 4: Descriptive data of percentage of average duration in the transition from bus setting.

Average Duration Percentage	Baseline	Follow-up
Mean	50.0	54.5
Median	55.5	50.0
SD	38.1	30.0

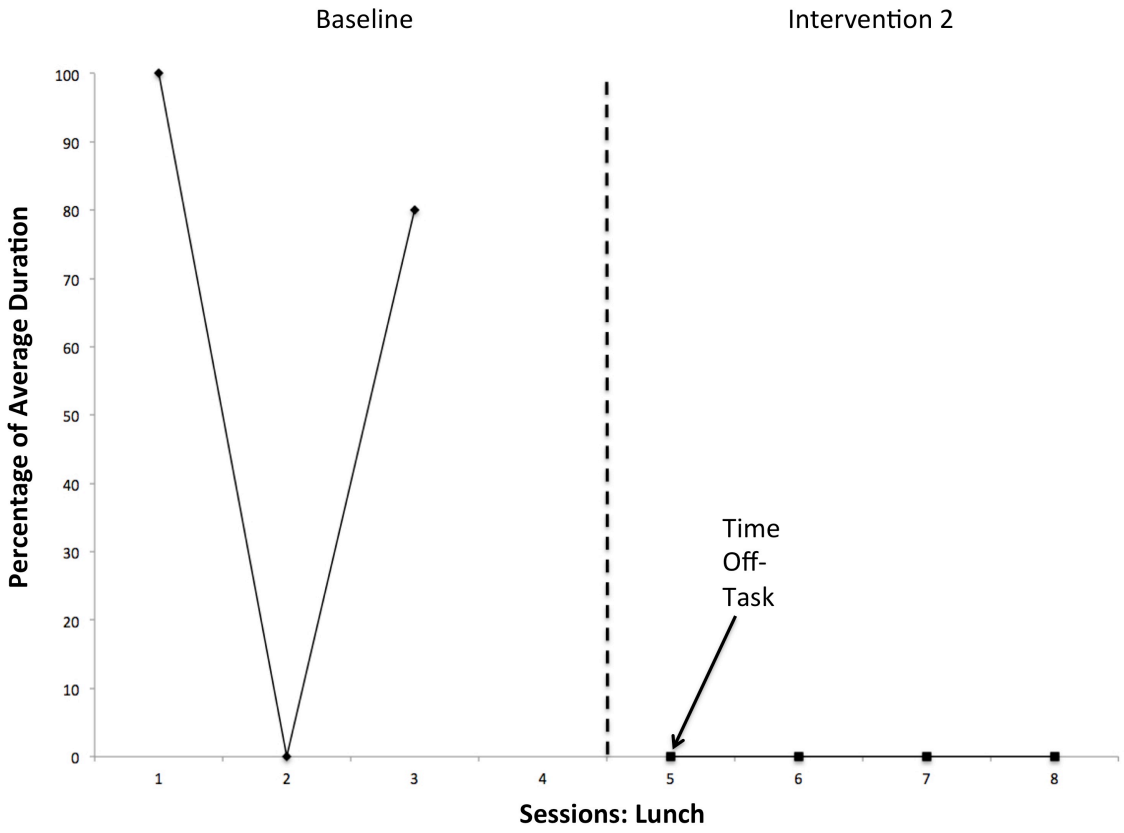

Figure 5: Average duration as a percentage of 300-second intervals of off-task behavior in the transition to/from lunch setting.

Table 5: Descriptive data of percentage of average duration in the transition to/from lunch setting.

Average Duration Percentage	Baseline	Follow-up
Mean	60.0	0.0
Median	80.0	0.0
SD	52.9	0.0
Variance	2800.0	0.0

TOPOGRAPHY OF OFF-TASK BEHAVIOR

Data were also taken on the topography of the off-task behavior and the total partial intervals of each challenging behavior. (See Tables 6 – 8.) The observers were

asked: “Did the off-task behavior result in the following types of behavior at any time during the interval?” If the behavior occurred at any time within the 300-second interval, the observer recorded “Yes”. Of the 1064 intervals in which data were collected, withdrawal was a consistent behavior during all phases of baseline (63.6%), token intervention (63.7%), and jacket intervention (63.4%). Aggression, which had been cited as a major concern by staff, occurred in only 1% of the intervals during baseline; however, the occurrences almost doubled (1.91%) during the token intervention and reduced by 75% (0.25%) during the jacket intervention. These results continued for SIB where partial-interval occurrences reduced from baseline data with the use of the jacket by nearly 15% (i.e., from 16.4% to 14.0%, respectively), yet increased with the use of the tokens (i.e., from 16.4% to 19.1%).

Table 6: Data collection on the topography of off-task behavior: withdrawal.

Phase	No	Yes	Total	% Yes
A – Baseline	182	318	500	63.6
B – Token Intervention	57	100	157	63.7
C – Jacket Intervention	149	258	407	63.4
Total	388	676	1064	

Table 7: Data collection on the topography of off-task behavior: aggression.

Phase	No	Yes	Total	% Yes
A – Baseline	495	5	500	1.00
B – Token Intervention	154	3	157	1.91
C – Jacket Intervention	406	1	407	0.25
Total	1055	9	1064	

Table 8: Data collection on the topography of off-task behavior: SIB.

Phase	No	Yes	Total	% Yes
A – Baseline	418	82	500	16.4
B – Token Intervention	127	30	157	19.1
C – Jacket Intervention	350	57	407	14.0
Total	895	169	1064	

SOCIAL VALIDITY

A survey on Google Forms was given to the teachers, paraprofessionals, and parent on the social validity of the study, interventions, and challenging behavior. One teacher, two paraprofessionals, and the parent responded. Each surveyed was asked to rate each of eight statements from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). (See Table 9 for results of the survey.) All four agreed that the intervention focused on a significant/severe behavior, was easy to use, and could be used at home with a rating of 80% or more out of 5. The agreement was 75% or more out of 5 that the intervention implementation was understandable and could be generalizable. There was agreement with a rating of 65% that the intervention provided a significant change and time requirements were reasonable. The teacher had the highest average rating of all questions (4.875), followed by the parent (3.875), and then the paraprofessionals (with 3.75 and 3.5).

Table 9: Results from the social validity survey. Agreement is the percentage of the average rating out of 5.

Statement:	The intervention focused on an important target behavior for the participant.	The use of the intervention is needed because the target behavior is severe and an impediment to the participant's educational achievement.	The intervention provided a significant change in terms of a reduction in the target behavior.	The steps to implementing the intervention (from my experience or understanding) were understandable.	The intervention (from my experience or understanding) was easy to use.	This intervention could be accurately used (from my experience or understanding) in any classroom.	This intervention could be accurately used (from my experience or understanding) at home.	The required time for use of the intervention was reasonable.
Average Rating	5	4.5	3.25	3.75	4.5	3.75	4	3.25
Range	5–5	4–5	3–4	3–5	4-5	2–5	3–5	1–5
Agreement	100%	90%	65%	75%	90%	75%	80%	65%

Chapter 4: Discussion

Sensory integration interventions have been used for decades even though the preponderance of empirical data does not support its use with individuals with ASD and/or ID as an intervention to challenging behavior. However, there are emerging devices and some evidence that SIT with DPT can be effective (Blairs, Slater, & Hare, 2007; McGinnis et al., 2013; Silva et al., 2015). One such DPT device is the T.Jacket, an emerging and structurally novel approach that is not functionally different from other SIT approaches. This study set out to examine if a technology-based DPT device could (a) decrease off-task behavior, (b) decrease challenging behaviors (i.e., withdrawal, aggression, and SIB), and (c) have social validity with an individual with ASD and ID. Visual analysis and descriptive data across phases and settings does not conclusively show that the study demonstrated experimental control of the variables and that either intervention (i.e., tokens or jacket) was consistently effective in reducing challenging behaviors for this one participant.

The topography of the participant's disability, behavior, and setting events could have significantly affected the data. This is supported by the wide variability in the descriptive and anecdotal data. For instance, MJ data was likely affected by a lack of sleep from the night before; the teacher learned during the study that the participant had been regularly waking up at 3 a.m., microwaving a meal, and staying up several hours before going back to bed (even though the participant had yet to consistently demonstrate these skills independently in the daily living activities). This would certainly explain why the majority of the withdrawal observed during MJ activities was sleep. This would also explain why the transition from the morning bus did not have conclusive decreases in off-task behavior. Nevertheless, there were several areas where there was some evidence that

the target behaviors decreased. Off-task and challenging behaviors showed some decrease with the jacket during the DLS activities and lunchtime transition, both of which had been cited by staff as some of the most frequent times for these behaviors (e.g., the teacher looked forward to seeing if the jacket would make a difference in these settings and remarked at the change, especially in using the jacket to/from lunch). In addition, when looking at the topography of challenging behaviors, there were decreases in self-injury and aggression while he wore the jacket. There were lower average durations of off-task behavior than baseline in the majority of settings (three-fifths) seen during the follow-up phase. However, conclusions cannot be drawn on the efficacy on the use of the jacket as a DPT device because experimental control was not established.

One explanation as to why two-thirds of the settings had lower duration after full implementation was because the participant needed time to acclimate to the DPT device. Observations of the data from session 43 to session 61/62 (i.e., post-full implementation) in all three FAC settings showed a decrease in average duration of off-task behavior. This was supported by descriptive data of average duration pre- and post-full implementation when compared to the average duration of baseline: sessions 31 – 42 of the MJ setting had 4 out of 12 sessions or 33.3% below the average duration for baseline and sessions 43 – 57 had 6 out of 12 sessions or 50% below the baseline; sessions 43 – 58 of the DLS setting had 12 out of the 15 or 80% below baseline average. In addition, the majority of instances that the participant took the jacket off during a session was pre-full implementation; the teachers believed that the app settings were making the jacket too tight and once they began using lighter settings there were near zero instances of jacket removal and off-task behavior decreased overall. For instance, the number of high points (i.e., average duration above 80%) in the MJ setting pre-session 43 was nine and the

number post-session 43 was five; in the WG setting, the number of high points pre-session 43 was four and the number post-session 43 was one.

LIMITATIONS

An overall limitation was a lack of experimental control. Whether it was due to setting events, the topography of challenging behavior, or antecedents (e.g., preference to certain teachers or paraprofessionals), the data was too varied and unpredictable to conclude either established or experimental intervention was effective in decreasing the duration of off-task behavior or occurrence of challenging behavior. In addition, results supporting social validity may be in question due to the lack of experimental control; supporting interventions may be inline with the phenomenon seen in SIT research and historical accounts where practitioners and care givers view the treatment as effective even when the evidence is overwhelming against such use (Davis et al., 2013; Doughty & Doughty, 2008; Ota, 2014; Stephenson & Carter, 2009; Zane, Davis, & Rosswurm, 2008).

There are some limitations to the study that may have affected the results and prevented the demonstration of experimental control. The first limitation is in the design of a single-subject study; implementing the jacket with multiple subjects may have provided a clearer visual analysis of the data. Another limitation is related to significant setting events, such as the participant's tiredness in the mornings due to his waking up early in the morning, which may have contributed to the high variability of the data in some of the settings during most of the phases. There may also be an error in the conclusion of his FBA and/or FA in the sense that many of his behaviors may not be due to escape, attention, or sensory sensitivity. The author relied on the data that were provided; instead an FBA/FA and preference assessment should have been conducted for

the purposes of the study and may have provided different procedures and results, including a different operational definition of off-task behavior. For instance, when he was observed (outside of data collection) working with the speech therapist, he was on task most of the time and speaking with a larger vocabulary than was seen with the FAC staff.

Another limitation may be due to the type of activity that was being asked or a lack of variety; for example, the MJ data were taken during pencil sharpening most of the time, which may alternatively explain why he had spikes of increased off-task and challenging behaviors during the jacket intervention. The constraints of the study and academic calendar partially dictated that phases be started with less stable baseline data, which may resulted in carryover into the subsequent phase; time constraints also prevented an examination of follow-up data on use of the token system. Finally, any results that provided evidence of decrease behaviors due to the use of the jacket should not be generalized to other individuals other than those with highly similar disabilities and similar behaviors.

IMPLICATIONS ON RESEARCH

Overall there is a lack of single-subject studies with multiple subjects or large-*n* experimental/control group studies that could provide more diverse and comprehensive data than from one single-subject participant. Furthermore, most of the current studies examine off-task or out-of-seat behaviors; future research may explore behaviors that are better related to sensory sensitivity such as SIB or aggression. Sensory issues with individuals of ASD with speech impairments and ID consistently impede success in school and meaningful participation in the community (Cheely et al., 2012; Mehling & Tassé, 2015; Siegel et al., 2015; Wilczynski et al., 2013; Zablotsky et al., 2012). Future

research may need to shift focus from how effective SIT is with the class of behaviors believed to be associated with sensory sensitivities to interventions that provide functional communication of those sensitivities and appropriate interventions based on the function of the behavior rather than misappropriating sensory-based antecedents as reasons for challenging behavior of individuals with ASD and/or ID.

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